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FEDERAL - STATE COOPERATIVE
SNOW SURVEYS AND IRRIGATION WATER FORECASTS
for

Montana and Northern Wyoming
Upper Missouri, Upper Columbia and
Yellowstone Rivers

By
Division of Irrigation, Soil Conservation Service
United States Department of Agriculture
and
Montana Agricultural Experiment Station

In cooperation with the U. S. Forest Service, U. S. Geological Survey, National Park Service, U. S. Bureau of Reclamation, State Engineers of Montana and Wyoming and other Federal, State and local organizations.

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FEDERAL-STATE COOPERATIVE SNOW SURVEYS

AND

IRRIGATION WATER FORECASTS

FOR

MONTANA and NORTHERN WYOMING

Upper Missouri and Upper Columbia River
Basins

Report Prepared
by

Ashton R. Codd: Hydraulic Engineer
Soil Conservation Service

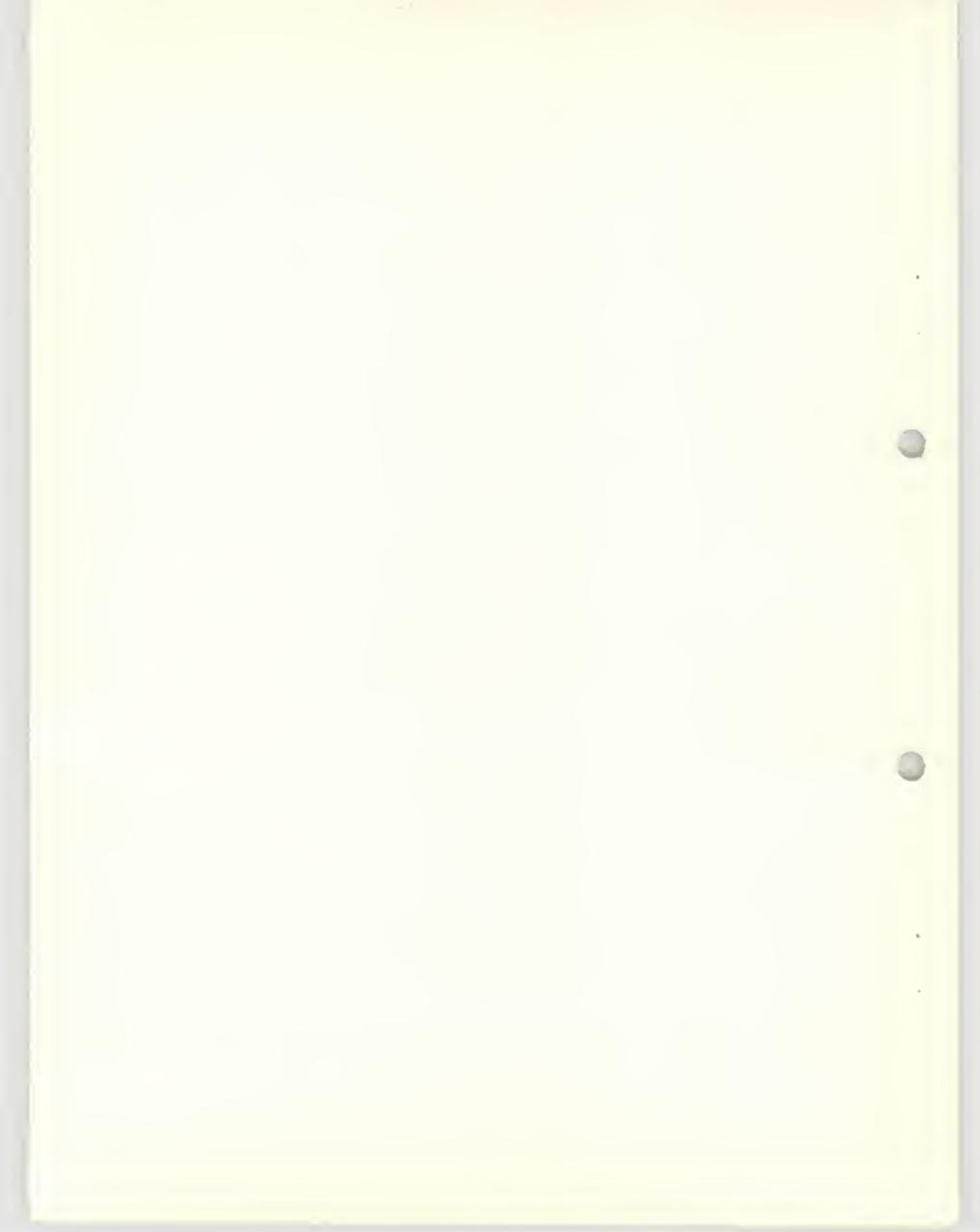
and

O. W. Monson: Irrigation Engineer
Montana Agricultural Experiment Station

Division of Irrigation
Soil Conservation Service

and

Montana Agricultural Experiment Station
Bozeman, Montana



IRRIGATION WATER SUPPLY OUTLOOK
APRIL 1, 1951

The snow pack on the watersheds of both the Upper Missouri and Upper Columbia, in Montana, is VERY GOOD although the present prospects are for a smaller runoff than 1950 or 1949.

The snow pack on the Lower Yellowstone River in Northern Wyoming is above average, and the resulting runoff will probably be as large, or larger than 1950 or 1949. Valley precipitation in the Columbia Basin has been above average, while in the Missouri and Lower Yellowstone, the Valley precipitation is below average. Streamflow during the winter and spring months have generally been above average from the mountains. Water storage in reservoirs throughout the State of Montana, and Wyoming, is good for this time of year. All reservoirs should be filled by the end of the Snow Melt Season.

A POTENTIAL FLOOD HAZARD exists on the Upper Columbia and Northern part of the Missouri again this season. The magnitude of this Hazard is entirely dependent on sequence of meteorological events that occur during the Melt Season, April-July. There is more snow water in the mountains this year than in 1948, which was a disasterous year due to the occurrence of high temperatures and precipitation during the Melt Season. A duplication of the 1948 Melt Season would produce equally high water in the Upper Columbia and parts of the Missouri tributaries.

The release of this bulletin has been withheld until after the Annual Meeting of the Upper Missouri River Water Forecast Committee Meeting, which was held on April 10 in Billings. Statements and forecasts are in agreement with the opinion of the committee.

JEFFERSON

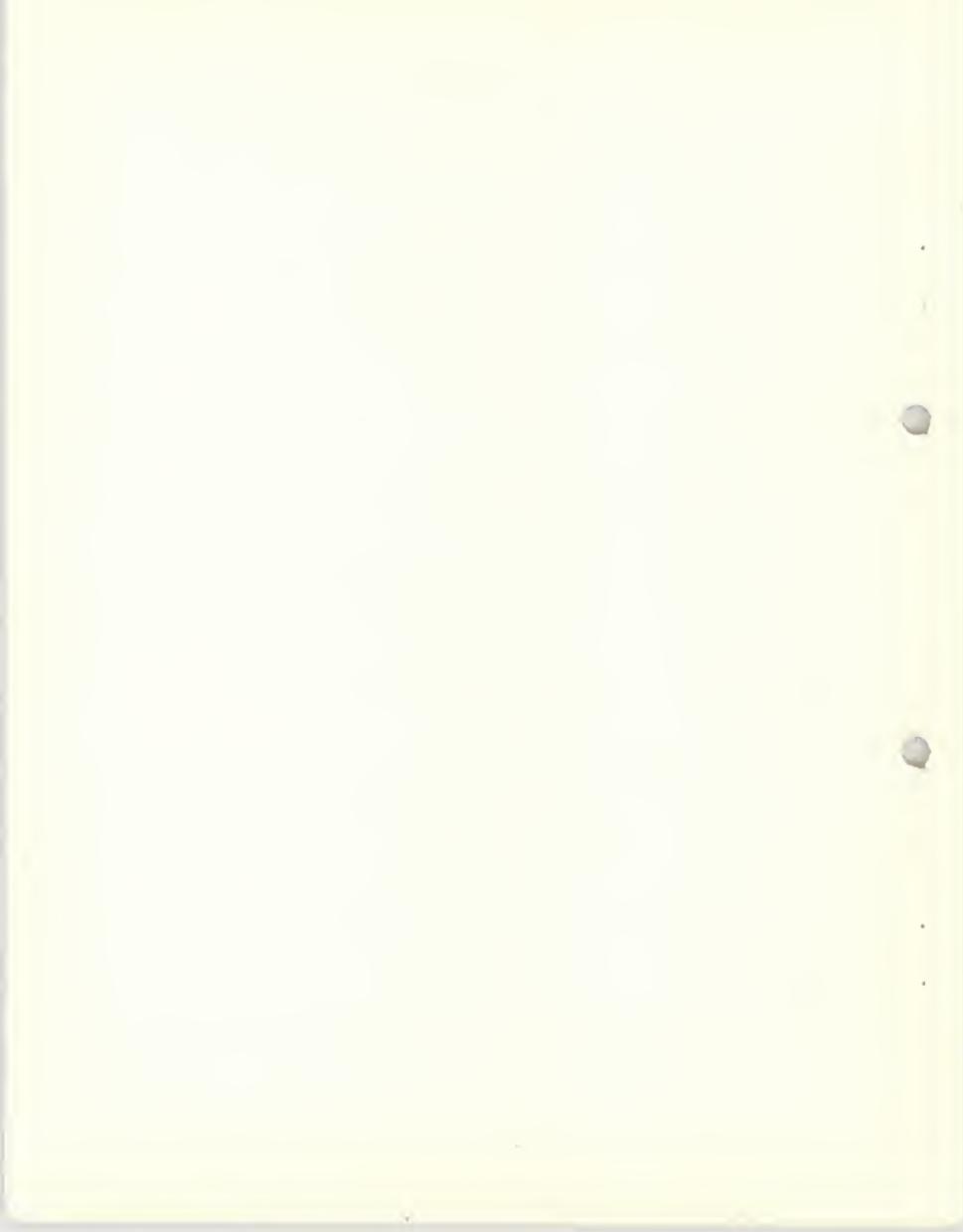
The Jefferson Basin should produce a good water supply for irrigation uses this season. The snow pack at most of the courses is greater than 1950 or 1949.

MADISON

The snow pack on the Madison River is above average, but NOT as large as 1950 or 1949. Stream flow should be about 16 per cent above average.

GALLATIN

The Gallatin River Basin has a good water supply in storage in the snow and should produce about 107 per cent of average flow, which is not as large as 1950.



MISSOURI MAIN STEM

The flow in the Main Stem of the Missouri is largely affected by that of the Jefferson, Madison and Gallatin. However, the Northern tributaries from Three Forks down stream are all in good shape this season. The Sun River has approximately the same volume of flow as 1950 and 1949, as well as the Teton. The Marias is slightly below last year, but above average. POSSIBLE FLOOD DAMAGE along these three tributaries is a definite threat this season, depending largely on the rapidity of melt, and the addition of more water by precipitation. At Fort Benton, on the Missouri, the forecast for the period May through June is 2,025,000 acre feet; and, 1,050,000 acre feet for the period July through September. The May-September forecast being 3,075,000 acre feet. This volume, with the water already entering Fort Peck Reservoir since October 1, should result in a yearly volume of approximately 8,000,000 acre feet.

UPPER YELLOWSTONE

Snow cover on the Upper Yellowstone River Basin is GOOD this season. The snow survey courses in Yellowstone Park and nearby tributaries indicate an above average snow pack, ranging from 108 to 126 per cent of average. The seasonal stream flow from May through September should reach 1,770,000 acre feet.

LOWER YELLOWSTONE (WYOMING)

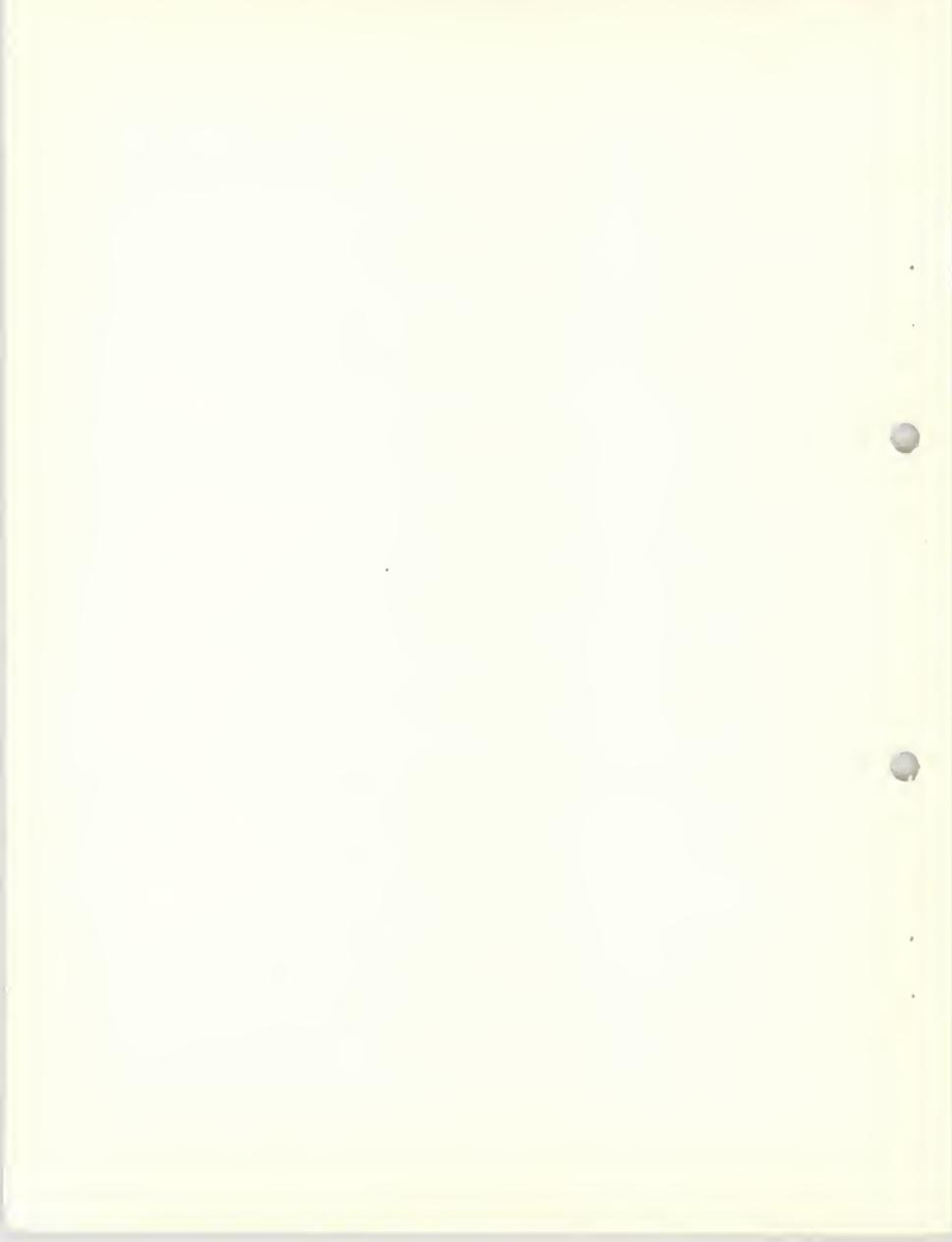
The snow pack on the Wind River is considerably above normal, and the stream flow from this basin should be above normal, reaching 670,000 acre feet between the months of April through September. This volume is 140 per cent of the average for this basin.

The Popo Agie River Basin is also well covered with an above normal snow pack; perhaps no as high as the Wind, but a very good season is expected.

The Big Horn River snow courses on the Owl Creek and Greybull Creek are above the short time average of 3 years that these courses have been established. At Sylvan Pass on the Shoshone, the course is 134 per cent above average. The flow below Buffalo Bill Reservoir, from April through September, should approximate 1,037,000 acre feet, or 130 per cent of the average flow for that season of the year.

COLUMBIA RIVER BASIN

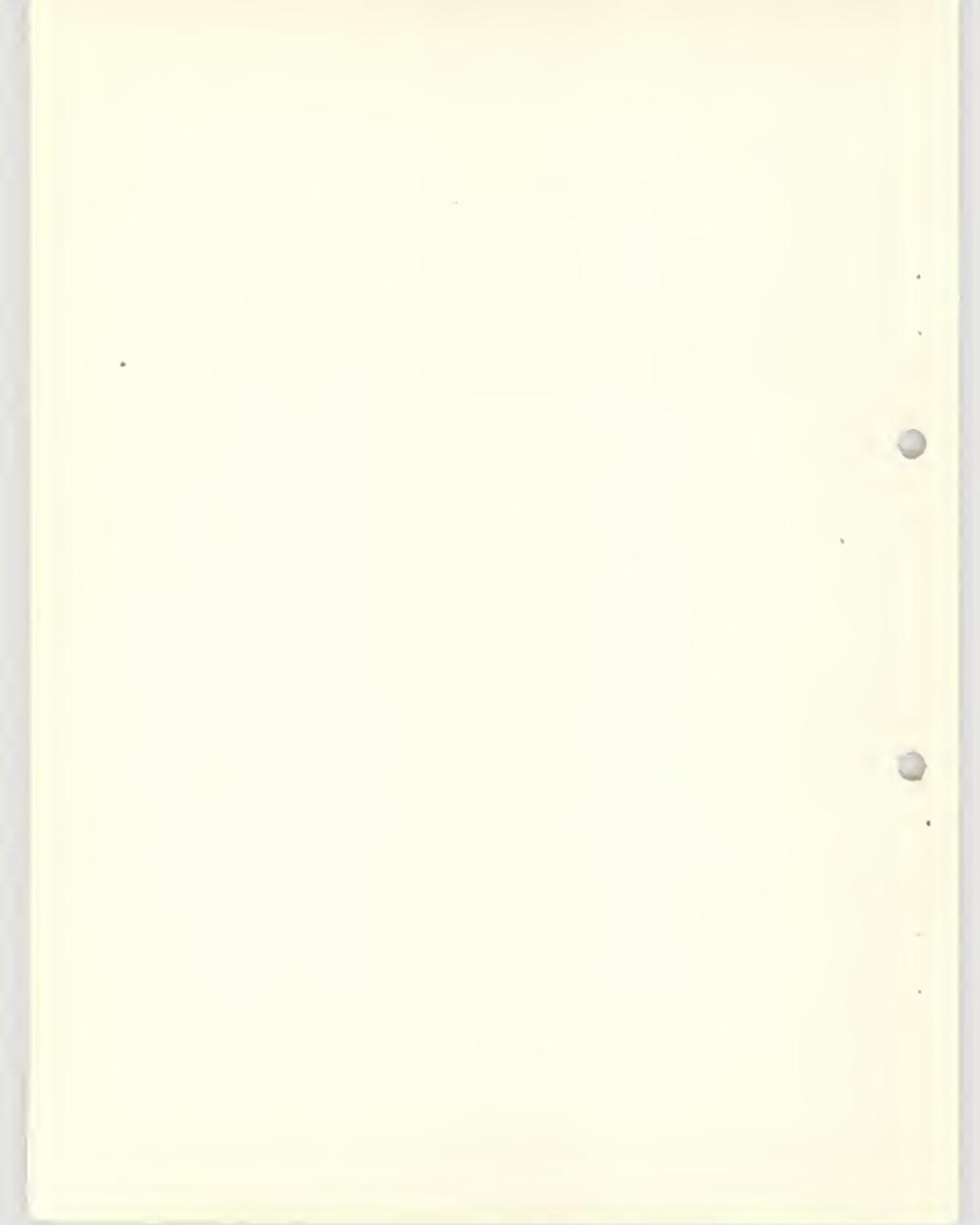
The Columbia River Basin, as a whole, has been visited by many good storms this season, and the snow pack is again above the average at most of the snow survey courses. The snow pack is not as heavy as 1950 or 1949, but there exists a higher snow water equivalent than in 1948. Inasmuch as the Columbia Basin produced some damaging flood waters in 1948, we are prone to use that year as a measuring stick for other years. The FLOOD HAZARD lies largely in the rapidity of snow melt and, also, on the quantity of precipitation that may fall during the snow melt season. Both of these factors were high during 1948, but were exceptionally low during 1949 and 1950. With an above average snow water equivalent, we should watch the temperatures and precipitation volumes during April, May and June.



KOOTENAI RIVER

The Kootenai River, in Canada and the United States, is covered by an above average snow pack, and should produce and EXCELLENT water supply. The Flathead River Basin has a snow pack of about 20 per cent above normal, while the Clark Fork is averaging about 15 per cent above average. On the Pend Oreille River, the snow course at Hodoo Creek reached 135 inches of depth with 56.6 inches of water equivalent. This is perhaps the maximum of the snow depths in the Upper Columbia, in Montana. The Bitterroot River Basin, also, has a good snow pack this season that ranges from 11 per cent above normal to 38 per cent above normal.

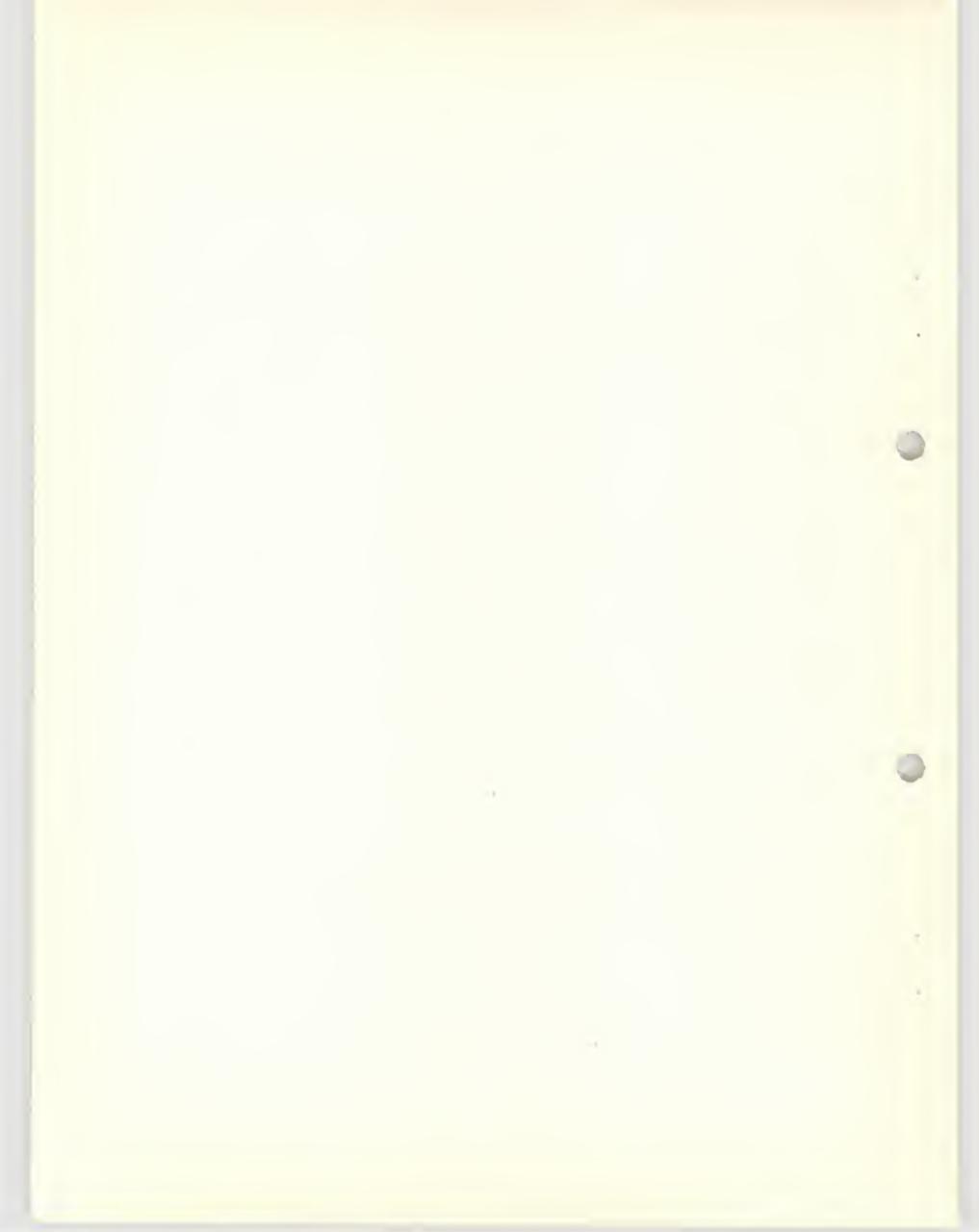
Forecast volumes for the Missouri, Columbia and Lower Yellowstone Rivers, are tabulated on the following page, listed under the season and station selected for the best correlations available at this time.



APRIL 1, 1951
 PRELIMINARY ESTIMATES OF RUNOFF OF REPRESENTATIVE
 STREAM GAGE STATIONS IN MONTANA AND NORTHERN WYOMING

NAME OF STREAM AND STATION	May-June	July-Aug. Sept.	May-Sept.	Percent Average
MISSOURI BASIN				
Gallatin River at Gateway	283,000	148,000	131,000	104
Madison River at West Yellowstone	101,000	76,000	177,000	116
Hyalite Creek at Ranger Station	20,400	11,200	31,600	102
No. Fk. Musselshell at Delphine	1,400	1,000	2,400	109
Judith River near Utica	22,570	8,600	30,580	82
Yellowstone River at Corwin Springs	1,050,000	720,000	1,770,000	107
Big Hole River at Melrose	567,200	223,400	790,600	138
Missouri River at Fort Benton	2,025,000	1,059,000	3,075,000	110
LOWER YELLOWSTONE RIVER (WYOMING)				
	April-June		April-Sept.	
No. Fk. Popo Agie River near Lander	47,500		60,960	111
Wind River at Riverton	352,300		570,300	140
Shoshone River below Buffalo Bill	574,800		1,037,900	130
Middle Fork Powder near Kaycee	66,430		75,150	102
Tongue River near Dayton	92,250		119,580	98
Tongue River at Acme	234,000		285,000	115
Goose Creek near Sheridan	48,210		58,470	85
UPPER COLUMBIA RIVER BASIN				
Bitterroot River at Darby	422,000		520,000	125
Clark Fork above Missoula	1,600,000		1,720,000	134
Clark Fork Below Missoula	2,700,000		3,110,000	132
Clark Fork at St. Regis	3,520,000		4,150,000	125
Flathead River at Columbia Falls	6,100,000		7,200,000	157
Flathead River at Polson	6,200,000		7,800,000	153
Clark Fork River at Plains	8,700,000		12,300,000	147
Clark Fork River at Heron	11,000,000		14,100,000	139

Note: Probable Error for these forecast is plus or minus 10 to 15% of the forecast value. Values of (r) range from 0.720 to 0.983.





SUPPLEMENTAL INDEX LIST OF SNOW SURVEY COURSES
IN ADJACENT BASINS, USED IN THIS REPORT AND
SHOWN ON THE INDEX MAP

DRAINAGE AND SNOW COURSE	Adj. State No.	Montana Number	Elev. Feet	Section Lat.	Twp	Range Long.	Record Began	Measurement Dates	Meas- ured By
<u>JEFFERSON</u>		Idaho							
Kilgore	10	11E12	6200	6	12N	39E	1937	1,2,3,4,5	pd. obs.
Blue Ridge Mine	5	11E11	6700	27	13N	38E	1938	4	pd. obs.
Camp Creek	6	12E3	6800	21	13N	36E	1936	1,2,3,4	1
Moose Creek	8	13D16	6200	22-27	27N	21E	1937	3,4,5	1
Big Springs	3	11E9	6500	34	19N	44E	1936	1,2,3,4,5	10
Island Park	9	11E10	3600	28	13N	43E	1936	1,2,3,4,5	10
Valley View	17	11E8	6500	7	15N	44E	1936	1,2,3,4	10
<u>UPPER YELLOWSTONE</u>		Wyo.							
Lewis Lake Div.	9	10E9	7900	44-13		110-40	1919	1,2,3,4	10
Aster Creek	2	10E8	7700	44-17		110-37	1919	1,2,3,4	10
Tom Thumb Summit		10E7	7900	44-22		110-35	1949	3,4	10
<u>LOWER YELLOWSTONE</u>		Wyo.							
(Wind River)									
Togwotee Pass	12	10F1	9600	29	44N	110W	1936	2,3,4,5	10
Kendall	25	9F12	7900	23	38N	110W	1936	3,4,5	1
Loomis Park	26	10F4	8500	14	37N	111W	1942	3,4,5	1
Yellow Jacket	14	10F5	6775	33	42N	112W	1936	3,4,5	1
Black Rock	2	10F3	8600	4	44N	111W	1936	2, 4	10
Dutch Jce	23	9G6	8700	32	31N	104W	1936	4,5	1
Mulligan Park	24	9G5	8900	17	35N	108W	1936	3,4,5	1
<u>KOOTENAI</u>		Idaho							
Smith Creek	13	16A1	4800	29	64N	3W	1937	4,5	1
		Canada							
Fernie	10		3500	49-31		115-01	1939		
New Fernie	10A		4100						
Gray Creek	34		5100	39-37		116-41	1948		
Marble Canyon	32		5000	51-12		116-09	1947		
Nelsen Creek	19		3050	44-25		117-14	1938		
Sinclair Pass	3A		4500	50-40		115-58	1947		
Sullivan Mine	20A		5100	49-43		116-01	1945		
Upper Elk River	41		4400	50-01		114-56	1947		
Kimberly	20		3800	49-41		115-59	1945		
<u>UPPER CLARK FORK</u>		Idaho							
49 Meadows	1	15B10	5000	6	43N	5E	1937	1,2,3,4,5	1
Lookout	10	15B2	5250	4	47N	6E	1921	1,2,3,4,5	1
Above Roland	2	15B7	4350	35	47N	6E	1926	3	12*
Below Roland	3	15B6	3770	34	47N	6E	1926	3	12
Sunset	16	15B9	5600	28	49N	5E	1921	3	12
<u>PEND OREILLE</u>		Idaho							
Mosquito Ridge	9	16A4	5110	5	54N	2E	1937	4,5	1
Freezeout #2		15B10	6800	21	15N	27W	1951	3,4	1

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DRAINAGE AND SNOW COURSE	Adj. State No.	Montana Number	Elev. Feet	Section Lat.	Twp	Range Long.	Record Began	Measurement Dates	Meas- ured By
BITTERROOT									
Moose Creek	8	13D16	6200	22-2 ¹ /4	27N	21N	1937	3,4,5	1
Kit Carson	3	14D3	4700	4	27N	16E	1937	4	1
Savage Pass	7	14C4	6000	18	36N	15E	1937	4	1
Powell Pasture	6	15C3	3700	27	27N	14E	1937	4	1
Packers Mdw.	5	14C2	5700	15	38N	15E	1937	2,3,4,5	1
FLATHEAD									
Basin Creek		13-B-14	5000	11	19N	12W	1951	2,3,4,5	1
Holbrook		13-B-13	4530	18	21N	13W	1951	2,3,4,5	1
Trout Lake #2		13-A-12	3600	21	28N	17W	1951	2,3,4,5	1
Twin Creeks		13-B-11	3580	14	26N	16W	1951	2,3,4,5	1
Quintonkon		13-A-13	3800	11	26N	17W	1951	2,3,4,5	1
TONGUE RIVER									
Burgess Ranger Sta.		7-E-4	7900	36	56N	89W	1950	3,4,5	Pd.Obs.
Dome Lake		7-E-5	8800	11	53N	87W	1950	3,4,5	Pd.Obs.
POWDER RIVER									
Soldier Park		7-E-6	8700	36	51N	85W	1950	3,4,5	Pd.Obs.1
Meddy Pass		7-R-7	9700	11	48N	85W	1950	3,4,5	Pd.Obs.1
North Powder		7-E-8	8500	5	47N	85W	1951	3,4,5	Pd.Obs

*Washington Water Power Company

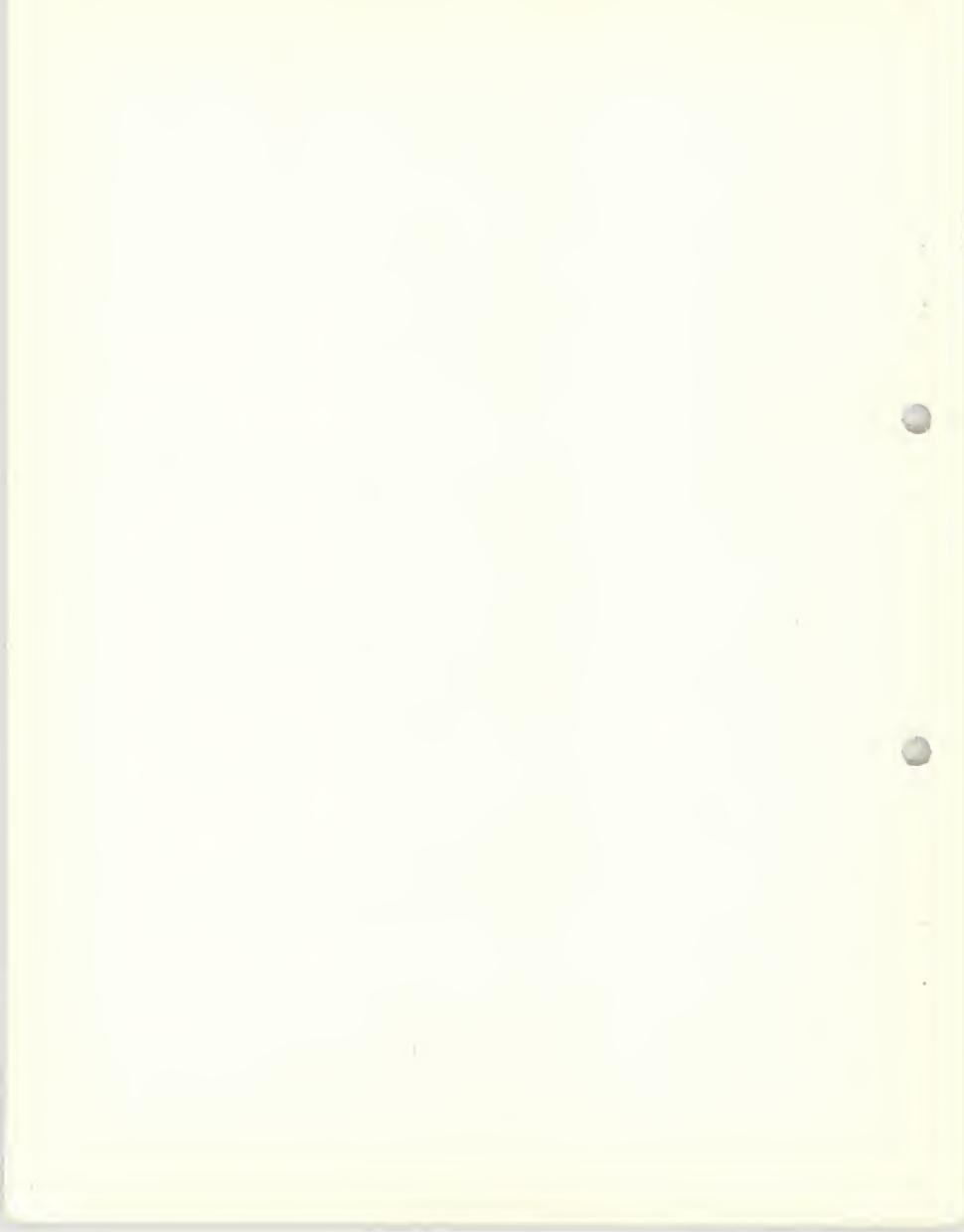
STORAGE IN RESERVOIRS OF MONTANA AND NORTHERN WYOMING
Reservoir Volumes in 1,000's of Acre Feet

Reservoir	Location on or Diversion from	Usable Capacity	Contents	Contents	April 1 10-Year Average
			This Year April 1 1951	Last Year April 1 1950	
Lake Sewall	Missouri	37.8	21.0	24.0	
Hauser Lake	Missouri	52.1	35.7	27.7	41.8
Holter Reservoir	Missouri	81.9	74.4	30.8	53.6
Fort Peck Res.	Missouri	19,000.0	12,960.0	11,240.0	9814.3
Ruby Reservoir	Ruby	38.5			
Hebgen Reservoir	Madison River	345.0	232.4	216.6	321.2
Madison Reservoir	Madison River	41.0	36.0	35.4	33.8
Smith River Res.	Smith River	10.7			
Gibson Reservoir	N.Fk. Sun River	105.0	80.6	46.6	65.7
Willow Creek	N.Fk. Sun-Willow Cr.	32.3	26.0	3.8	13.7
Pishkun Reservoir	N.Fk. Sun River	32.0	18.9	18.8	15.5
Lower Two Medicine L.	Two Medicine River	14.0			
Four Horns Res.	Badger Creek	20.0		6.0	8.1
Birch Creek Res.	Birch Creek	30.0	30.0	21.3	22.6
Lake Francis Res.	Birch Creek	112.0	96.5	83.3	77.6
Askley Lake	Judith River	5.8		4.4	4.3
Durand Reservoir	N.Fk. Musselshell	7.0	6.1	6.4	
Dead Man Basin	Musselshell River	52.5			
Martinsdale Res.	S.Fk. Musselshell	23.1	12.1	11.0	9.4
Fresno Reservoir	Milk River	127.2	99.9	17.7	61.2
Nelson Reservoir	Milk Reservoir	66.8		5.7	31.7
Mystic Lake	W.Rosebud Creek	20.8	5.2	4.3	5.7
Cooney Reservoir	Red Lodge Creek	27.5	14.1	14.1	10.9
Tongue Reservoir	Tongue River	73.9	9.0	13.9	13.7
Sherburne Lake Res.	Swiftcurrent Creek	66.1		38.0	21.1
Lake Helena	Missouri River	10.4	3.2	1.1	
YELLOWSTONE RIVER BASIN (Wyoming)					
Buffalo Bill	Shoshone	456.6	269.1	169.4	333.8
Pilot Butte	Wind River	30.1	13.8	13.7	15.0
Bull Lake	Wind River	155.0	79.5		57.6
COLUMBIA RIVER BASIN (Montana)					
Georgetown Lake	Flint Creek	31.0	19.9	18.4	22.6
E.Fk.Rock Cr.Res.	E.Fk. Rock Creek	16.0			
W.Fk.Bitterroot Res.	E.Fk. Bitterroot	31.7	10.0	3.5	7.8
Como Lake	Rock Creek	34.8			
Flathead Lake (Sommers)	Flathead River	1,791.0	651.6	614.1	319.4
*Little Bitterroot	Little Bitterroot	37.1	35.7	29.0	9.8
*Dry Fork Reservoirs	Dry Fork Creek	6.7	5.1	4.9	2.5
**Mission Valley 9 Reservoirs	Mission Valley (Flathead River)	105.0	52.5	31.8	39.3

*Comprised of two reservoirs on Little Bitterroot River.

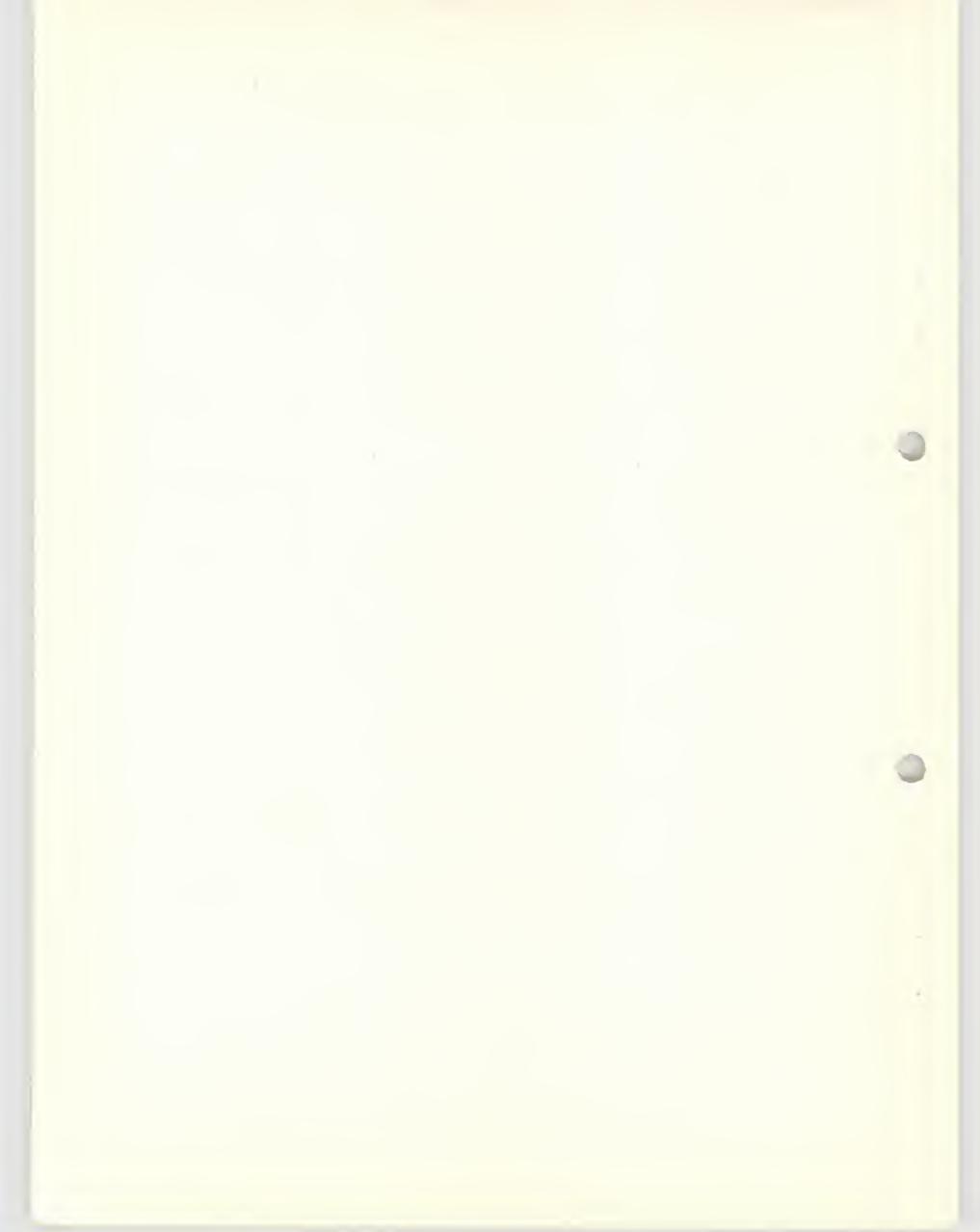
*Comprised of two reservoirs on Dry Fork Creek.

**Comprises nine small reservoirs on Mission Valley Indian Irrigation Service Project.



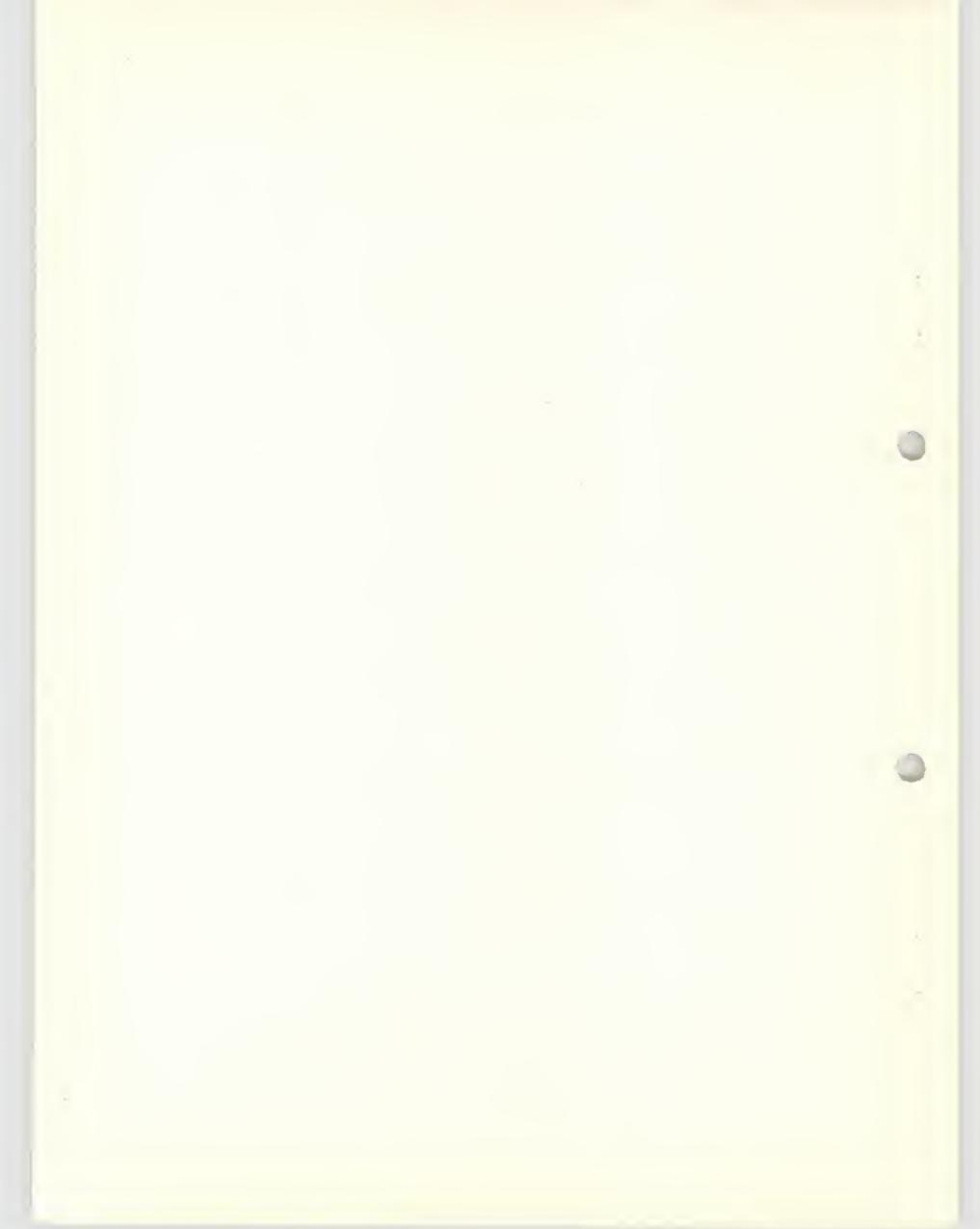
PRECIPITATION DATA FOR APRIL 1, 1951
MONTANA

Station	Elev- ation	1950			1951			Mar. Dept. from Normal	Seasonal Accumulation			
		Precipitation			Precipitation				1950-51	Precipitation		
		Oct.	Nov.	Dec.	Jan.	Feb.	Mar.			Normal	Departure	
<u>WEST OF DIVIDE</u>												
Butte (Airport)	5533	0.53	1.20	0.59	0.92	0.82	1.01	+0.37	5.07	3.13	+1.94	
Phillipsburg	5280	0.51	1.25	0.64	1.43	1.45	1.85	+0.87	7.13	5.03	+7.13	
Hamilton	3529	1.78	1.58	0.71	1.21	1.52			4.66			
West Glacier	3154	5.87	2.35	5.17	4.77	4.88	1.89	+0.23	24.93	15.11	+9.82	
Summit (Marias)	5213	7.53	6.13	5.83	5.37	6.52	3.66	+0.38	35.09	17.54	+17.55	
Ovando 1 SW	4101	1.02	2.38	1.63	1.53	1.72	1.12	-0.11	9.40	8.71	+0.69	
Trout Creek	2485	6.36	3.95	4.67	5.42	6.51	1.96	-1.09	28.87	19.77	+9.10	
Thompson Falls	2435	4.36	2.79	2.25	2.97	3.44			11.57			
Average (8)		3.50	2.70	2.69	2.95	3.36	1.91	+0.10	17.11	10.39	+6.72	
<u>CENTRAL DIVISION</u>												
Babb	4300	1.04	1.23	0.85	0.65	1.79			5.98			
Haile	2488	0.21	0.41	0.32	0.39	0.42	0.54	+0.03	2.31	3.63	-1.32	
Great Falls (Airport)	3664	0.03	1.19	0.58	0.41	1.34	1.22	+0.36	4.77	4.23	+0.54	
Helena (Airport)	3893	0.13	1.50	0.61	0.38	0.24	0.84	+0.05	3.99	3.27	+0.72	
Lewistown (Airport)	4132	0.74	0.83	1.05	0.17	0.20	0.61	-0.42	3.60	3.30	+0.30	
Livingston	4485	0.94	1.05	0.81	0.38	0.40	1.45	+0.59	5.03	4.51	+0.52	
Wisdom	6058	1.06	1.15	0.48	0.71	0.93	0.53	-0.29	4.86	4.57	+0.29	
West Yellowstone	6669	2.88	1.79	1.95	2.28	1.91	2.18	-0.04	12.99	12.72	+0.27	
Mystic Lake	6558	0.86	2.37	1.08	2.02	0.17	3.50	+1.45	10.00	8.73	+5.27	
Average (9)		0.91	1.28	0.85	0.82	0.82	1.36	-1.57	6.63	5.66	+0.97	
<u>EASTERN DIVISION</u>												
Malta	2255	0.39	0.18	0.35	0.49	0.52	0.53	-0.01	2.46	2.98	-0.52	
Fort Peck	2180	0.21	0.25	0.23	0.48	0.39			2.65			
Medicine Lake	1962	0.50	0.10	0.21	0.36	0.49	0.25	-0.16	1.91	2.40	-0.49	
Circle	2428	0.54	0.18	0.13	0.33	0.50	0.05	-0.95	1.73	4.45	-2.72	
Billings	3139	0.83	0.88	0.68	0.70	0.38	0.69	-0.15	4.14	4.44	-0.30	
Miles City	2392	0.40	0.52	0.31	0.08	0.27	0.14	-0.72	1.72	4.11	-2.39	
Glendive	2076	0.45	0.16	0.07	0.37	0.42	0.12	-0.72	1.59	3.59	-2.00	
Broadus	3026	0.46	0.41	0.40	0.48	0.31	0.60	-0.12	2.66	3.76	-1.10	
Average (8)		0.48	0.34	0.30	0.41	0.41	0.34	-0.66	2.27	3.55	-1.28	



PRECIPITATION DATA FOR APRIL 1, 1951
NORTHERN WYOMING

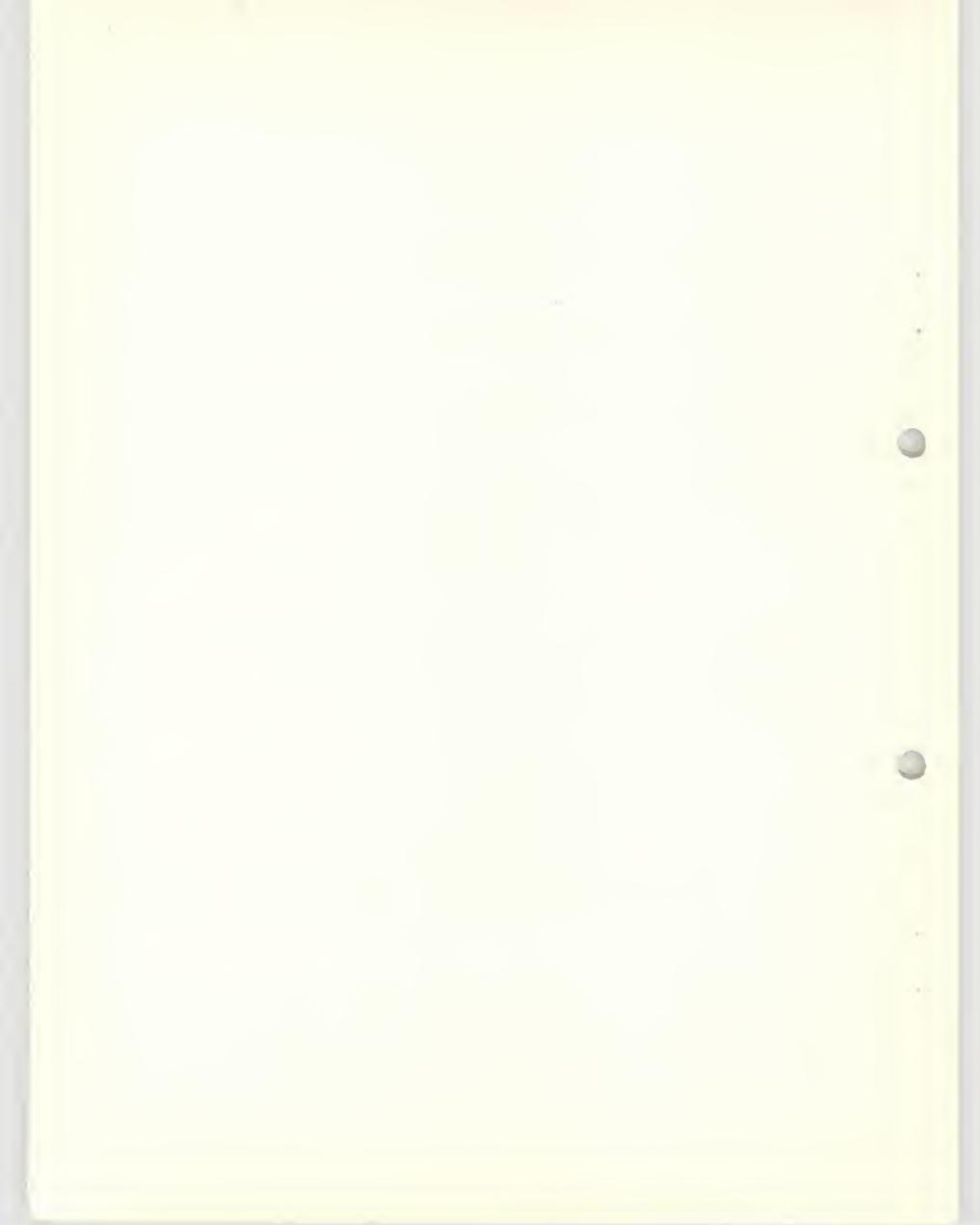
Station	Elev- ation	1950 Precipitation			1951 Precipitation			Mar. Dept. from Normal	Seasonal Accumulation		
		Oct.	Nov.	Dec.	Jan.	Feb.	Mar.		1950-51	Normal	Departure
<u>BIG HORN RIVER BASIN</u>											
Cody	4984	.08	1.29	.28	.77	0.09	0.58	+0.08	3.00	2.62	+0.38
Lovell	3825	.02	.32	.03	.09	T	0.10	-0.25	0.56	2.19	-1.63
Worland	4061	T	.10	.40	T	0.10	0.30	-0.11	0.96	2.34	-1.41
Sunshine 4 SW	6930	.17	1.04	.29	.37	0.67	0.29	-0.94	2.83	5.19	-2.36
Thermopolis	4336	.19	.80	.21	.07	0.18	0.09	-0.83	1.43	3.86	-2.43
Riverton	4954	.22	.57	.00	.05	0.31	0.45	-0.04	1.34	2.75	-1.41
Dubois	6917	.37	.71	T	.16	0.45	0.80	+0.26	2.17	2.98	-0.81
Average (7)		.15	.68	.17	.22	0.25	0.37	-0.26	1.75	5.05	-3.30
<u>TONGUE RIVER BASIN</u>											
Sheridan	4021	.51	1.05	.58	.55	0.24	1.20	+0.04	4.13	5.05	-0.92
<u>POWDER RIVER BASIN</u>											
Arvada	3680	.22	.31	.06	.16	0.18	0.81	+0.04	1.74	3.61	-1.87
Metz Ranch	5280	.37	.57	.19	.16	0.38	0.43	-0.39	2.50	3.46	-0.96
Gillette	4542	.63	.72	.05	.50	0.25	1.30	+0.30	3.45	4.46	-1.1
Nine Mile Creek	5000	.70	.40	.05	.20	0.50	0.30	-0.45	2.15	3.08	-0.93
Mid West	4850	.83	.47	.28	.23	0.27	0.35	-0.69	2.53	4.47	-1.94
Average (5)		.55	.51	.31	.34	0.32	0.66	-0.24	2.47	3.82	-1.35



MONTANA SNOW SURVEYS APRIL 1, 1951

MISSOURI BASIN DRAINAGE BASIN AND SNOW COURSE **	No.	Elev.	Date of Survey 1951	Snow Depth (In.) 1951	Apr. 1 1951			Past Records		Average April 1 Avg.	Years of Record	Ground Surface Condition
					1950	1949	1951					
					1951	1951	1951					
JEFFERSON RIVER (Rock-Beaverhead)												
Lakeview Ridge	11E3	7400	Apr. 2	36.3	10.1	11.6	10.0	10.4	98	4	---	---
Lakeview Canyon	11E4	6930	Apr. 2	43.7	11.3	10.3	12.7	11.4	99	4	---	---
Limekiln	11E2	6950	Mar. 8	NO	SNOW	0.8	4.1	7.7	--	4	G.N.F.	G.N.F.
White Pine Ridge	11E1	8850	Mar. 8	21.2	4.4	7.2	7.2	7.4	59	4	---	---
*Kilgore	11E12	6200	Mar. 29	30.0	8.6	15.5	11.0	10.7	81	15	---	---
*Camp Creek	12E3	6800	Mar. 30	29.0	8.3	13.9	10.7	8.9	94	16	---	---
*Blue Ledge Mine	11E11	6700	Mar. 29	44.0	14.9	26.1	16.7	15.7	95	14	---	---
(Hornet Prairie)												
Bloody Dick	13D10	7600	Mar. 13	50.4	15.4	11.6	15.2	12.3	125	4	G.N.F.	G.N.F.
Gold Stone	13D9	8100	Mar. 13	61.2	20.5	15.2	19.0	15.7	130	4	G.N.F.	G.N.F.
Lemhi Pass	13E1	7400	Mar. 9	46.6	12.5	9.5	11.8	10.8	116	4	G.N.F.	G.N.F.
Terrell Creek	13D12	6650	Mar. 10	28.4	6.8	3.0	6.0	4.2	160	4	G.N.F.	G.N.F.
Trail Creek	13E2	7090	Mar. 9	42.0	10.8	7.4	10.4	9.8	110	4	G.N.F.	G.N.F.
Selway Junction	13D11	6500	Mar. 10	42.3	11.6	7.5	12.8	9.8	119	4	G.N.F.	G.N.F.
(Big Hole)												
Big Hole Pass	13D3	7440	Mar. 14	61.2	21.1	18.2	24.5	19.7	107	4	G.N.F.	G.N.F.
Big Hole Pass(Below)	13D4	6900	Mar. 14	51.4	17.6	15.4	19.6	16.2	109	4	G.N.F.	G.N.F.
East Boundary	13D5	6700	Mar. 14	35.9	12.5	8.8	11.8	10.2	122	4	G.N.F.	G.N.F.
Jahnke Creek	13D8	7340	Mar. 13	47.4	14.0	10.8	14.4	12.1	196	4	G.N.F.	G.N.F.
Miner Forks	13D6	7300	Mar. 12	53.2	17.3	11.4	13.8	13.2	131	4	G.N.F.	G.N.F.
Miner Lake	13D7	6720	Mar. 12	37.3	10.2	7.6	10.6	8.4	122	7	G.N.F.	G.N.F.
(Wise River)												
Anderson Meadow	13D14	7000	Mar. 16	35.8	10.0	8.3	10.6	6.4	157	4	G.N.F.	G.N.F.
Elk Horn	13D15	8150	Mar. 31	41.9	12.7	10.0	13.6	9.2	138	13	G.N.F.	G.N.F.
Wise River	13D13	6300	Mar. 16	23.8	5.6	5.2	7.4	5.8	98	4	G.N.F.	G.N.F.
(Ruby River)												
Cottonwood	11E2	5900	Mar. 21	31.0	8.8	11.5	11.9	9.9	89	4	G.N.F.	G.N.F.
Cottonwood (Upper)	11E1	8400	Mar. 21	31.7	10.2	12.1	11.6	10.6	97	4	G.N.F.	G.N.F.
Flashlight	12D3	6950	Apr. 2	18.9	5.7	4.2	6.7	5.5	103	4	G.N.F.	G.N.F.
Tobacco Root	12D2	6900	Mar. 20	33.7	10.4	11.4	13.3	11.5	91	4	G.N.F.	G.N.F.
Vigilants	11D1	6125	Mar. 21	NO	SNOW	3.3	0.0	0.8	80	4	G.F.	G.F.

*Adjacent Basin

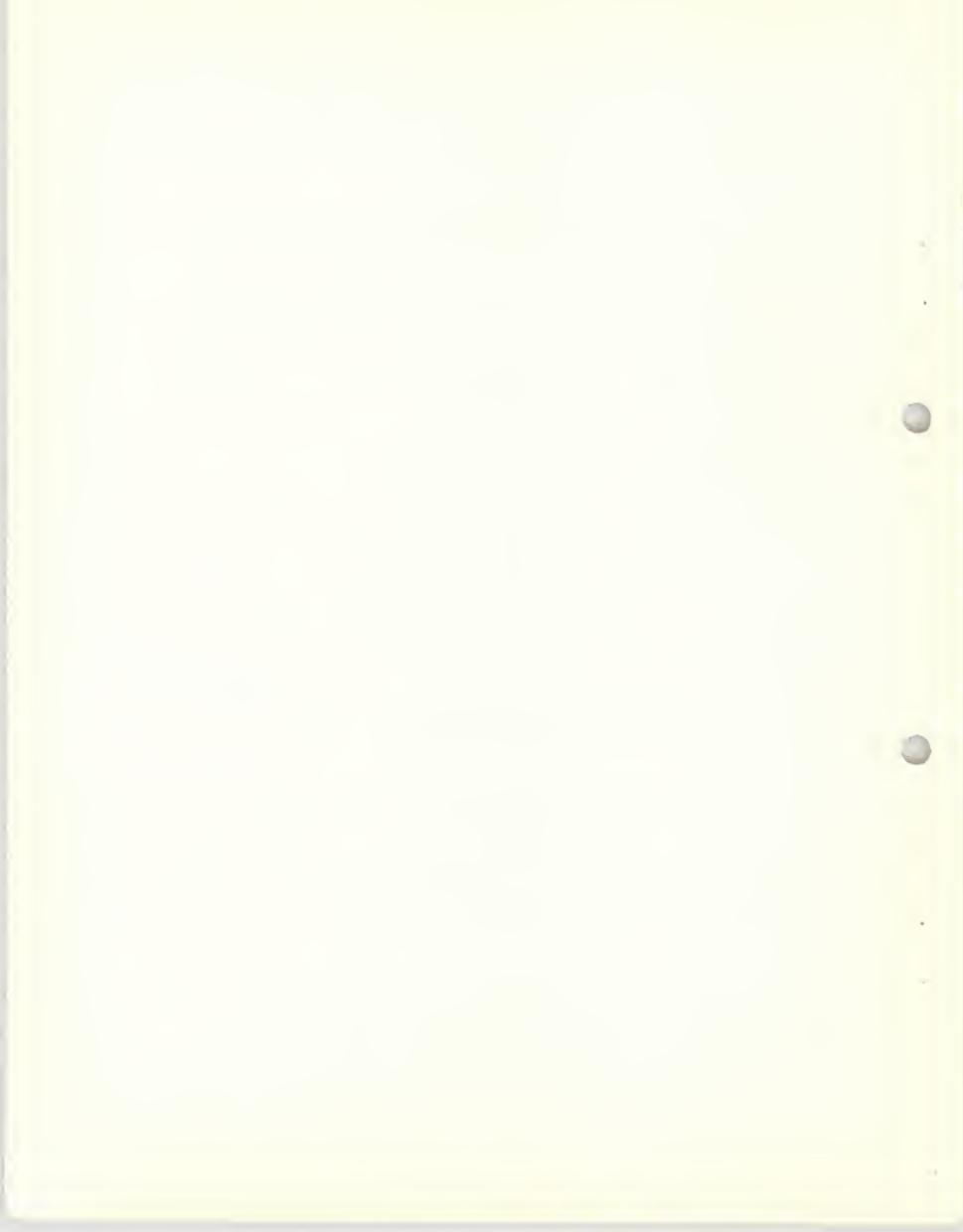


MONTANA SNOW SURVEYS, APRIL 1, 1951

MISSOURI BASIN

DRAINAGE BASIN AND SNOW COURSE **	No.	Elev.	Date of Survey 1951	Snow Depth (In.) 1951	Apr. 1 1951	Water Content (Inches)				Years of Record	Ground Surface Condition		
						Average Data							
						Past Records 1950	April 1 1949	Avg.	%Avg.				
MADISON RIVER													
Hebgen	1135	6550	Mar. 30	35.2	10.9	14.0	14.6	12.1	88	16	G.F.		
West Yellowstone	1137	6700	Mar. 29	42.5	15.9	14.1	11.2	11.2	115	15	G.F.		
21-Mile	11E6	7150	Mar. 29	56.3	19.2	21.0	20.6	16.5	116	15	G.N.F.		
*Big Springs	1139	6500	Mar. 28	62.0	22.4	25.9	27.8	20.5	109	16	--		
*Island Park	11310	3600	Mar. 29	53.0	17.6	21.6	22.5	15.4	115	16	--		
*Valley View	1138	6500	Mar. 29	48.0	14.9	19.5	18.8	14.6	109	16	--		
Norris Basin	10E2	7500											
GALLATIN RIVER													
Devil's Slide	10D4	8100	Mar. 31	62.1	19.9	20.2	21.0	13.8	100	13	G.F.		
Hood Meadow	10D3	6600	Mar. 31	31.1	9.4	7.3	10.9	8.4	112	13	G.F.		
Mystic Lake	10D2	6600	Apr. 4	25.6	8.1	8.4	10.7	7.5	108	15	G.N.F.		
New World	10D1	6700	Apr. 4	33.3	10.6	10.8	11.4	10.0	95	13	G.F.		
21-Mile	11E6	7150	Mar. 29	56.3	19.2	21.0	20.0	16.5	116	15	G.N.F.		
MISSOURI RIVER MAIN STEM													
Chessman Reservoir	12C5	6200	Mar. 30	15.4	4.6	4.4	7.6	4.6	100	16	--		
Crystal Lake	9C1	6100	Mar. 29	37.2	10.6	10.5	15.4	12.0	89	11	G.N.F.		
Grasshopper	10C2	7000	Apr. 3	13.0	11.0	5.8	8.1	5.1	78	14	--		
Kings Hill	10C1	7950	Mar. 29	45.8	13.7	17.1	16.9	13.2	104	13	--		
Picnic Grounds	13C6	6500	Mar. 31	81.5	5.6	2.6	7.6	4.2	113	7	--		
Pipestone Pass	12D1	7200	Apr. 1	28.0	6.8	4.2	7.9	5.7	120	13	--		
Stample Pass	12C1	6900	Mar. 29	42.4	11.1	11.6	13.5	9.5	117	13	--		
Tenmile, Lower	12C2	6250	Apr. 2	26.4	8.3	7.6	8.8	6.4	130	16	--		
Tenmile, Middle	12C3	6800	Apr. 2	42.2	12.0	12.8	12.8	10.3	116	16	--		
Tenmile, Upper	12C4	8000	Apr. 3	47.5	15.4	15.8	14.8	13.2	117	16	--		
(Teton River)													
Fright Creek	12B1	6000	Mar. 28	63.5	22.3	22.3	17.9	19.0	117	4	G.N.F.		
Waldron Creek	12B2	5600	Mar. 27	28.1	9.4	10.7	9.5	8.9	108	4	G.N.F.		
West Fork	12B1	6000	Mar. 27	61.3	21.0	21.6	19.9	19.8	106	4	G.N.F.		

*Adjacent Basin

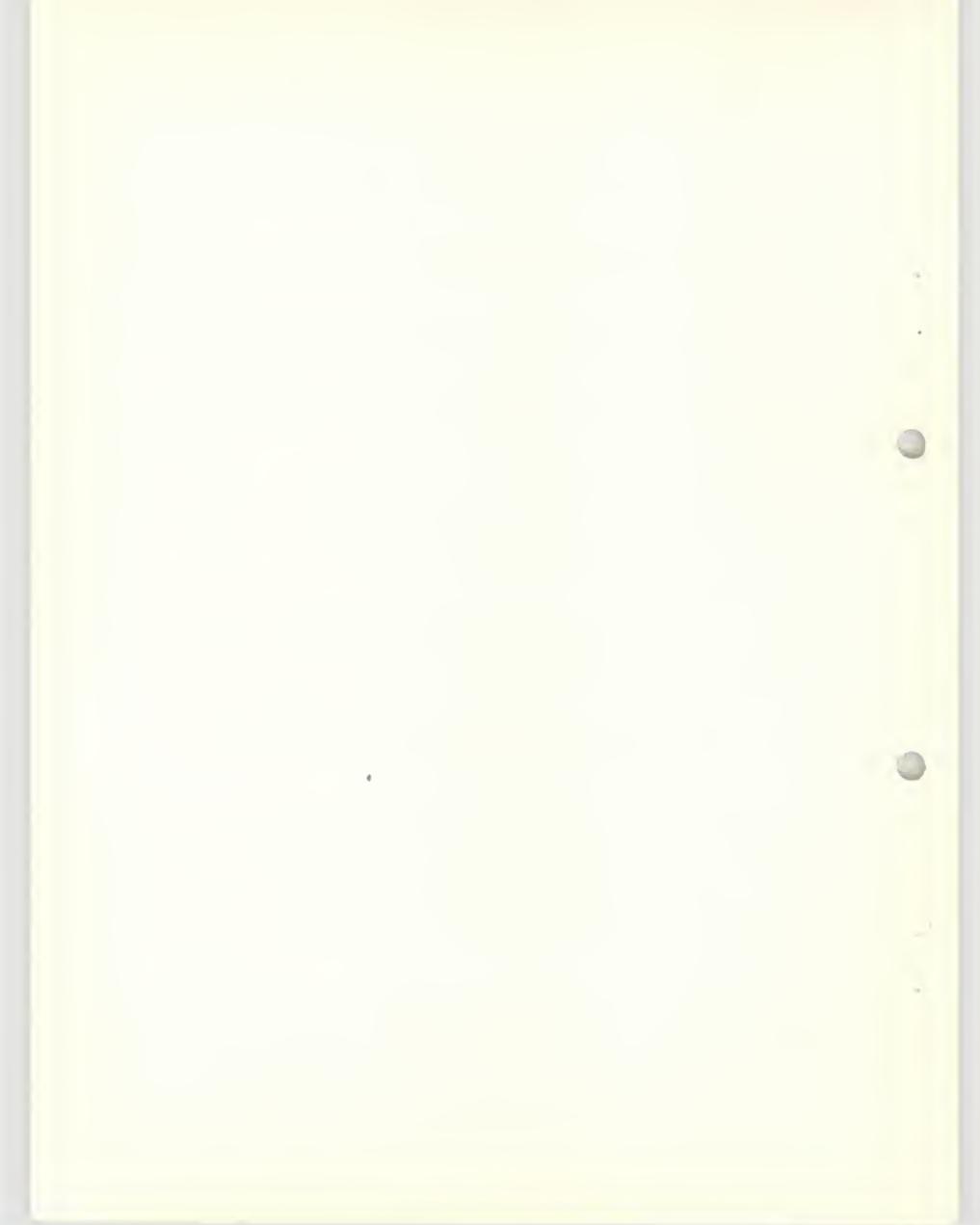


MONTANA SNOW SURVEYS, APRIL 1, 1950

MISSOURI BASIN

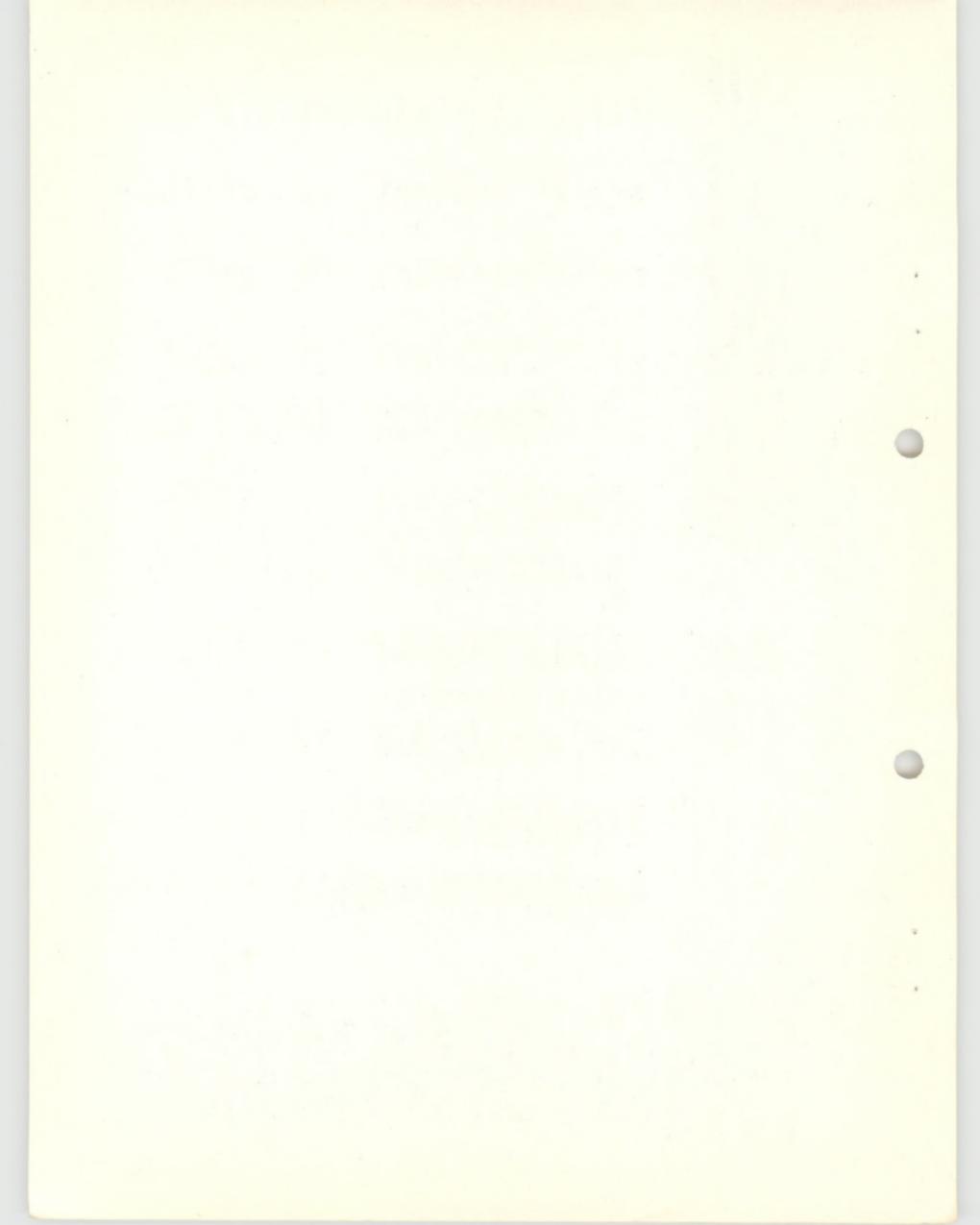
DRAINAGE BASIN AND SNOW COURSE **	No.	Elev.	Date of Survey 1951	Snow Depth (In.) 1951	Apr. 1 1951	Water Content (Inches)				Years of Record	Ground Surface Condition		
						Past Records		Average Data April 1					
						1950	1949	Avg.	%Avg.				
(Sun River)													
Benchmark	1286	5500	Mar. 26	34.0	12.3	12.8	12.0	11.6	105	4	---		
Cabin Creek	1286	5400	Apr. 5	21.6	6.7	9.5	7.5	7.9	85	3	---		
5-Bull	1289	5600	Mar. 26	27.1	9.2	9.2	8.8	9.0	102	4	G.N.F.		
Gates Park	1285	5300	Apr. 5	37.9	11.5	13.1	11.7	12.1	95	3	---		
Goat Mountain	1287	7000	Mar. 31	42.7	12.7	15.2	13.4	13.0	127	13	---		
My Lake	1389	7300	Apr. 3	95.5	40.5	51.1	40.5	40.5	2	2	---		
Wrong Ridge	1283	6800	Mar. 30	68.0	26.2	28.5	22.5	25.7	102	3	---		
Wrong Creek	1284	5700	Mar. 29	51.0	17.3	20.0	15.7	17.8	97	3	---		
(Marias River)													
Marias Pass	1285	5250	Mar. 29	66.8	24.5	28.7	21.4	17.5	146	16	---		
Snow Lab. #16	13A9	5200	Mar. 29	69.4	25.2	28.2	23.4	23.5	100	5	---		
(Milk River)													
Rocky Boy	9A1	5200	Apr. 1	12.8	3.8	5.1	6.7	5.5	69	10	---		
UPPER YELLOWSTONE													
Camp Senia	901	7890	Mar. 29	31.3	6.8	5.8	7.4	7.2	94	22	---		
Canyon	10E3	7750	Apr. 1	56.5	18.9	18.5	18.3	16.5	114	6	---		
Cooke City	10D7	7400	Mar. 31	32.8	9.2	8.4	10.6	7.5	121	15	---		
Crevice Mt.	10D5	8100	Apr. 1	34.0	9.5	9.4	13.0	9.8	97	17	---		
Independence	10D6	8000	Mar. 28	59.4	19.2	21.2	22.7	17.7	108	10	G.N.F.		
Lake Camp	10E4	7850	Mar. 31	41.2	11.7	12.6	15.2	9.3	126	16	---		
Lodgepole, Wyo.	9E1	8200	Apr. 1	44.9	15.8	--	14.8	10.9	14	14	---		
Lupine	10E1	7309	Apr. 2	36.6	10.8	11.7	11.2	9.8	110	13	---		
*Lewis Lake Divide	10E9	7000	Apr. 1	117.0	50.4	51.3	47.1	45.1	112	32	---		
*Astor Creek	10E8	7700	Apr. 1	97.0	39.0	39.0	39.0	39.0	112	5	---		
*Tom Thumb Summit	10E7	7900	Apr. 1	74.0	27.8	28.6	27.4	25.0	112	5	---		
(Shieds River)													
Porcupine	10C3	9200	Mar. 27	19.3	5.8	5.7	9.1	4.7	123	13	G.F.		
(Musselshell River)													
Grasshopper	10C2	7000	Apr. 3	13.0	4.0	5.8	8.1	5.1	78	14	---		

*Adjacent Basin



MONTANA SNOW SURVEYS APRIL 1, 1951

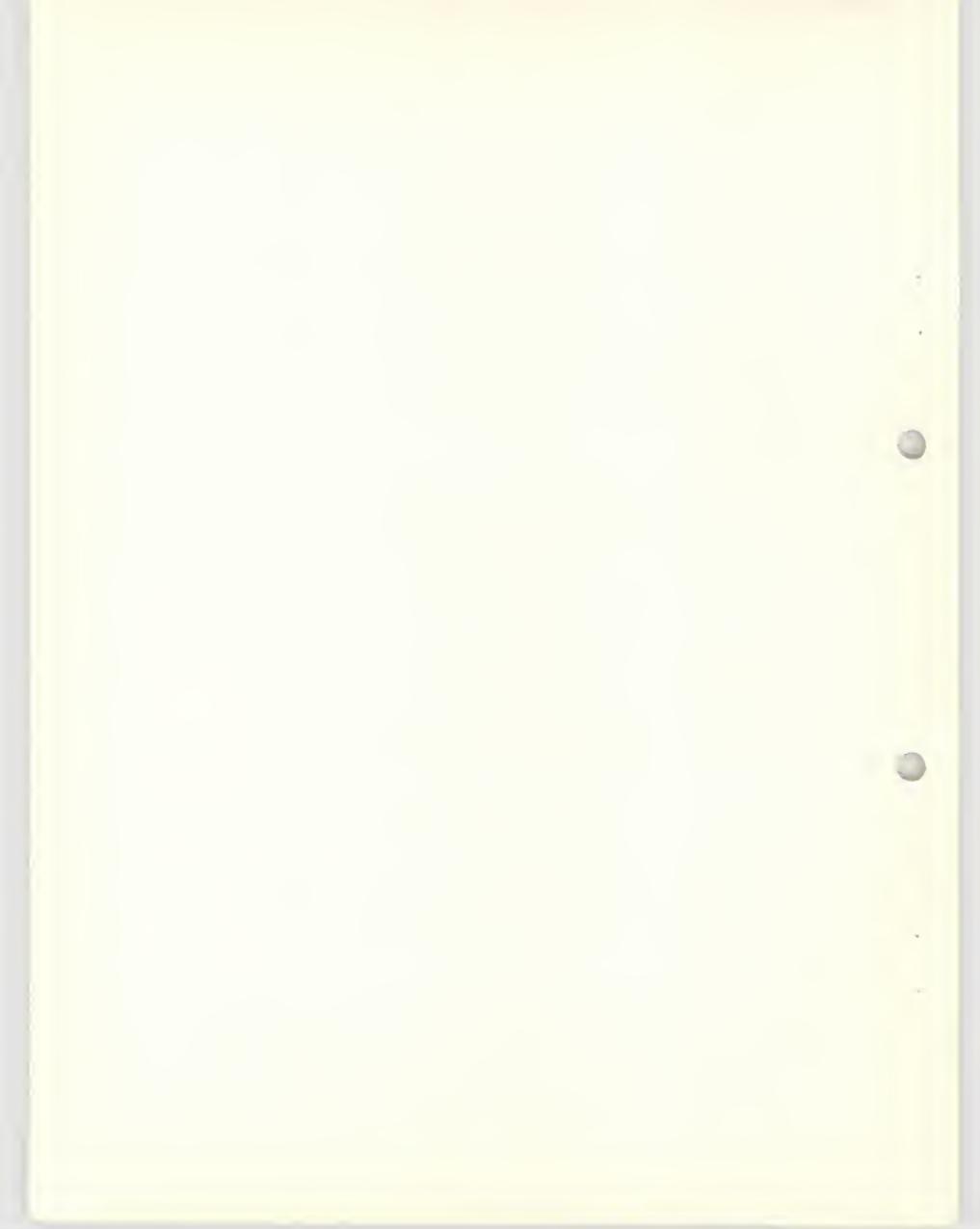
MISSOURI BASIN



MONTANA SNOW SURVEYS APRIL 1, 1951

MISSOURI BASIN

DRAINAGE BASIN AND SNOW COURSE **	No.	Elev.	Date of Survey 1951	Snow Depth (In.) 1951	Apr. 1 1951	Water Content (Inches)				Years of Record	Ground Surface Condition		
						Past Records		Average Data April 1					
						1950	1949	Avg.	%Avg.				
BIG HORN RIVER (Wyoming)													
Beavers Mill	9E8	8000	Mar. 30	36.2	9.1	8.9	7.9	8.6	106	3	---		
Owl Creek	8F1	8700	Mar. 31	32.6	7.3	6.2	6.6	6.7	109	3	---		
Tensleep R. S.	7B3	8300	Mar. 31	28.9	7.2	8.4	3.5	6.9	104	15	---		
Timber Creek	9E2	9000	Mar. 30	24.2	7.2	4.7	7.5	6.5	111	3	---		
Ranger Creek	7E1	8800											
Wood River	9E7	8000	Mar. 29	25.0	7.4	5.0	7.4	5.7	130	10	---		
SHOSHONE RIVER													
East Entrance	10E6	7000	Mar. 30	14.2	14.8	11.5	17.6	14.6	101	3	---		
Sylvan Pass	10E5	7100	Mar. 30	53.5	19.2	18.6	19.4	14.3	134	14	---		
TONGUE RIVER													
Burgess Junction	7E4	7900	Apr. 4	14.3	15.8	12.0		13.9	114	2	---		
Big Goose	7E2	7700	Apr. 4	15.3	3.8	2.5	5.3	4.3	89	16	---		
Dome Lake	7E5	9000	Apr. 4	28.9	7.2	5.9		6.6	109	2	---		
POWER RIVER													
North Powder	7E8	8500	Mar. 26	28.6	6.8	--	--	--	--	1	---		
Muddy Pass	7E7	9700	Apr. 2	31.0	8.1	--	--	--	--	2	---		
Sour Dough	6F1	8500	Apr. 5	26.6	7.0	5.1	7.7	6.0	117	15	---		
Soldier Park	7E6	8700	Apr. 4	24.7	5.8	4.6		5.2	--	2	---		
CHEYENNE RIVER (South Dakota)													
Upper Spearfish	1 S.D.	6500	Apr. 1	15.8	3.5	7.9	10.8	6.6	53	8	---		
Upper Castle	2 S.D.	6800	Apr. 1	22.5	4.2	8.8	9.1	5.2	81	8	---		
Deerfield	3 S.D.	6000	Apr. 1	5.9	1.9	8.8	9.1	4.2	45	8	---		



MONTANA SNOW SURVEYS APRIL 1, 1951

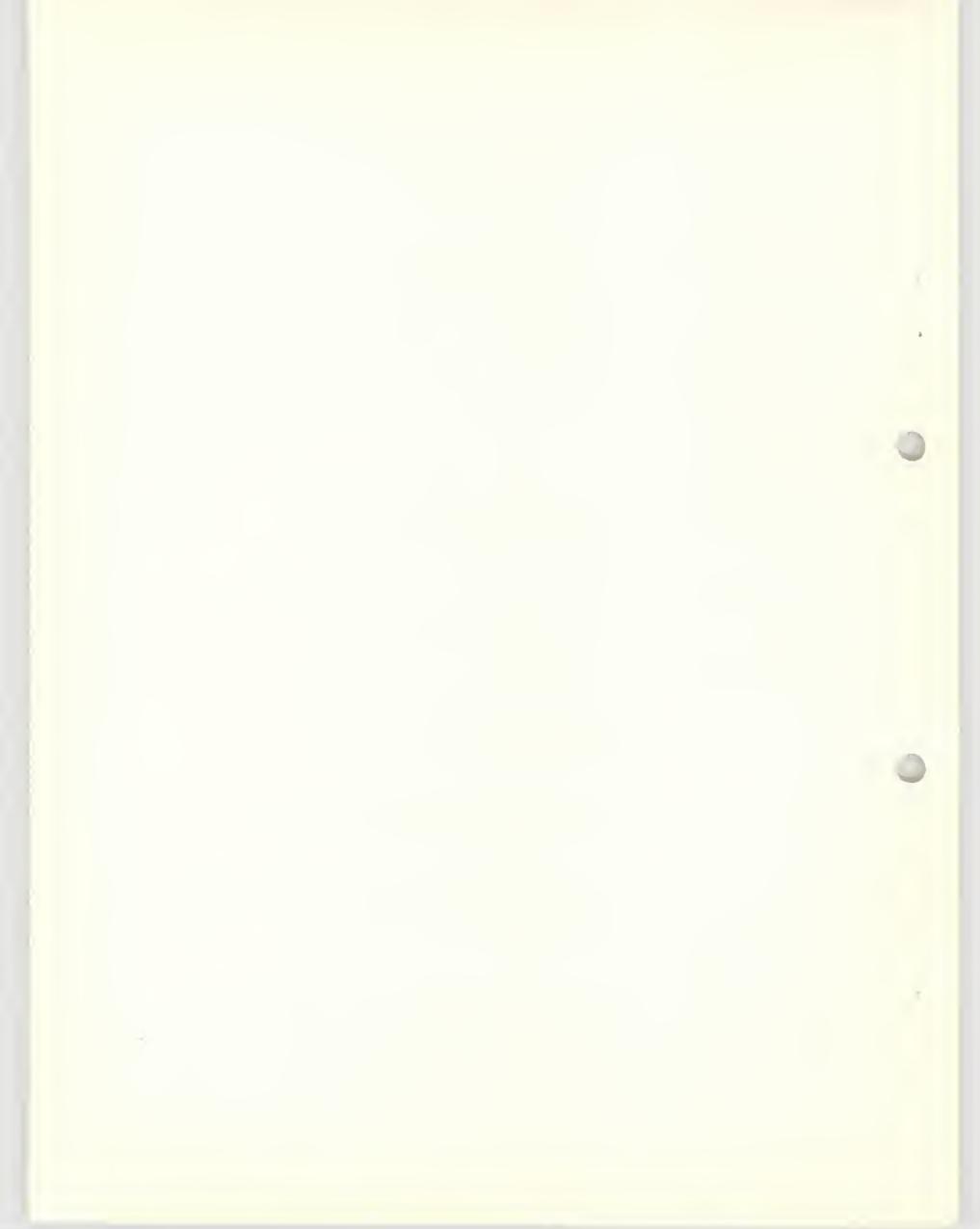
MISSOURI BASIN

DRAINAGE BASIN AND SNOW COURSE **	No.	Elev.	Date of Survey	Snow Depth (In.)	Apr. 1	Water Content (Inches)			Years of Record	Ground Surface Condition
			1951	1951	1951	Past Records	Average Data April 1	Avg.		

COLUMBIA RIVER DRAINAGE IN MONTANA

KOOTENAI

Baree Mountain	15B1	6000	Mar. 30	109.3	44.2	61.3	55.2	39.7	111	13	G.N.F.
Blue Bird Basin	14A1	6800	Mar. 28	120.2	45.3	46.8	38.2	35.5	128	13	---
Brush Creek	14A4	5000	Apr. 1	36.7	11.6	13.9	19.0	12.0	96	7	---
Fernie	Canada	3500	Mar. 29	24.5	11.6	14.9	7.7	7.8	149	15	---
New Fernie	Canada	1100	Mar. 30	47.3	16.7	New Course			1	---	---
Ferguson	Canada	3000	Mar. 31	55.2	23.7	22.9	21.1	19.5	122	14	---
Gerrard	Canada	6000	Apr. 3	64.1	17.3	15.2	12.5	14.5	119	17	---
Gray Creek	Canada	5100	Mar. 29	68.3	23.0	24.0	20.5	21.8	105	4	---
Kimberley	Canada	3800	Apr. 1	32.6	9.4	11.2	7.1	5.3	177	14	---
Marble Canyon	Canada	5000	Mar. 30	64.5	22.0	15.7	13.0	15.0	146	5	---
Nelson Creek	Canada	3050	Mar. 30	40.7	18.0	19.9	18.8	13.5	133	14	---
Red Mountain Mont.	13A1	6000	Apr. 3	62.5	22.0	30.4	21.3	18.4	120	13	---
Sandon	Canada	3500	Mar. 31	36.6	11.8	14.5	12.8	10.7	110	14	---
Sinclair Pass	Canada	4500	Mar. 31	31.3	9.3	5.9	3.6	4.9	120	15	---
Smith Creek	16A1	4800	Mar. 31	127.0	50.5	58.1	49.3	41.8	121	13	---
Sullivan Mine	Canada	5100	Mar. 31	60.0	18.8	21.2	15.3	16.2	115	6	---
Upper Elk River	Canada	1400	Mar. 31	37.0	10.9	10.6	7.5	9.5	115	4	---

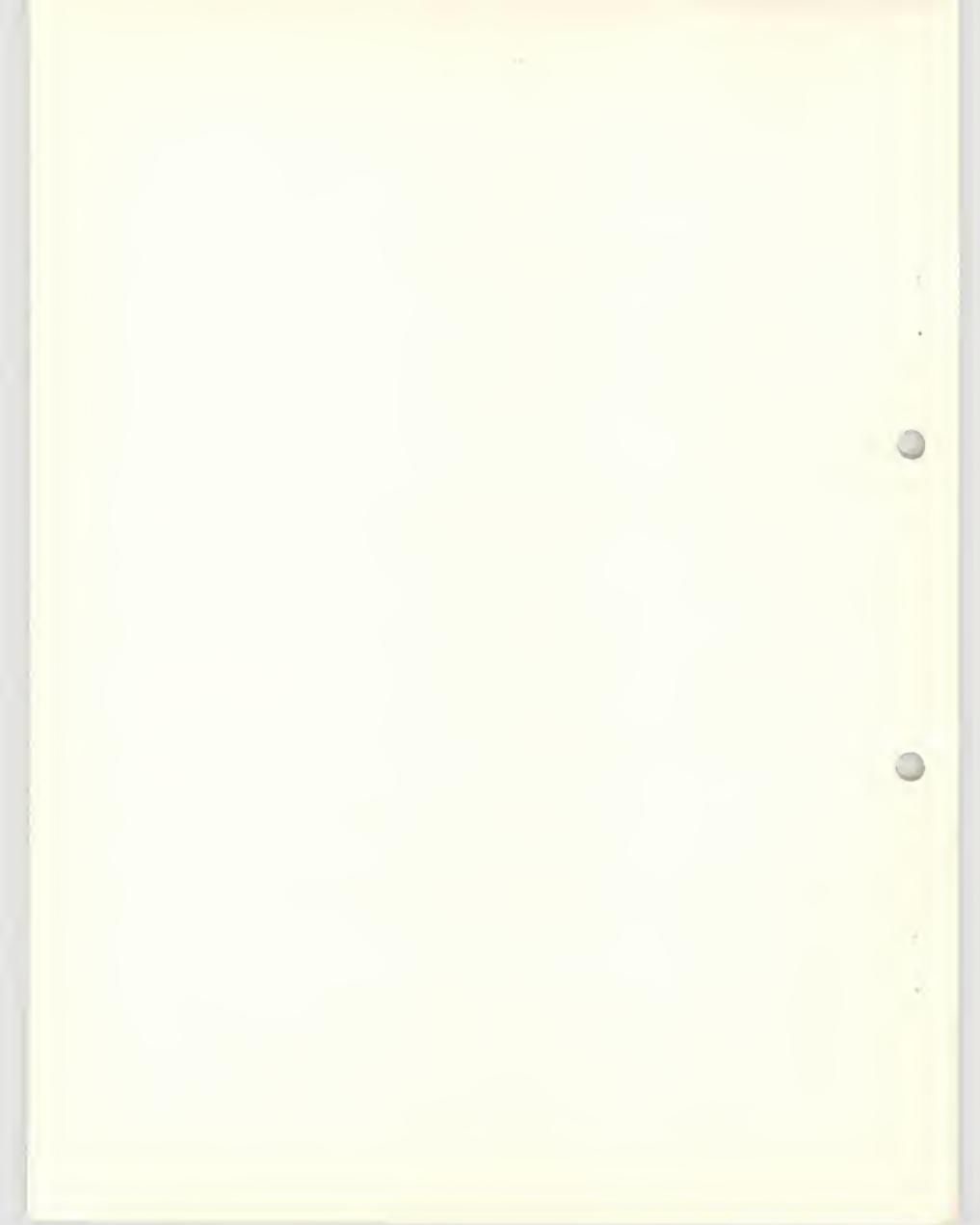


MONTANA SNOW SURVEYS, APRIL 1, 1951

COLUMBIA RIVER BASIN

DRAINAGE BASIN AND SNOW COURSE **	No.	Elev.	Date of Survey 1951	Snow Depth (In.)	Water Content (Inches)				Years of Record	Ground Sur- face Condition	
					Apr. 1 1951	Average Data April 1					
						1950	1949	Avg.	% Avg.		
FLATHEAD RIVER											
Big Creek	13B3	6750	Apr. 2	108.3	144.0	53.8	39.5	40.1	111	11	
Brush Creek	14A4	5000	Apr. 1	36.7	11.6	18.9	19.0	12.0	96	7	
Cattle Queen	13A1	4700	Mar. 31	98.3	37.5	45.2	33.5	30.3	124	13	
Desert Mountain	13A2	5600	Mar. 29	61.0	21.6	23.3	19.3	15.2	140	13	
Hell Roaring Divide	14A3	5700	Mar. 30	81.5	27.7	37.6	33.4	29.5	94	10	
Kishenehn	14A2	4300	Mar. 29	31.4	10.3	10.7	7.9	8.1	128	6	
Limestone Pass	13B8	7600	Apr. 1	121.8	51.1	51.7	46.3	48.9	105	4	
Logan Creek	14A5	4300	Apr. 2	29.2	8.6	10.3	12.5	8.0	108	13	
Marias Pass	13A5	5250	Mar. 29	66.8	21.5	28.7	21.4	17.5	146	16	
North Fork Jocko	13B7	6330	Mar. 31	114.6	45.8	56.3	40.0	39.6	118	11	
Rainy Lake	13B6	4300	Apr. 1	118.8	5.1	18.9	11.5	11.9	43	5	
Snow Lab. #16	13A9	5200	Mar. 29	69.4	23.2	28.2	23.4	23.5	99	5	
Spotted Bear Mt.	13B2	7000	Apr. 1	41.6	11.6	19.2	19.6	17.2	85	4	
Strawberry Lake	13B10	6500	Apr. 2	99.5	41.7	59.1	47.8	48.1	87	4	
Trinkus Lake	13B1	6500	Mar. 28	110.7	40.8	57.3	45.0	47.7	86	4	
Trout Lake	13B11	3600	Mar. 30	48.7	19.4	27.0	20.7	20.4	95	4	
Trout Lake #2	13A12	3600	Mar. 30	47.9	18.5						
Upper Holland Lake	13B5	7000	Mar. 29	100.7	37.0	50.8	36.9	41.6	89	3	
Basin Creek	13B14	5000	Apr. 2	26.6	9.1	New Course				1	
Holbrook	13B13	4530	Apr. 2	21.2	7.8	New Course				1	
Quintonkon	13A13	3800	Apr. 1	41.9	15.7	New Course				1	
Twin Creeks	13B11	3580	Apr. 1	25.0	9.5	New Course				1	
UPPER CLARK FORK											
Chessman Res.	12C5	6200	Mar. 30	15.4	4.6	4.4	7.6	4.6	100	16	
East Fork R. S.	13D1	5400	Mar. 29	30.6	9.2	7.6	10.8	5.1	178	13	
El Dorado Mine	13C9	7800	Apr. 3	66.6	25.2	26.1	22.3	24.5	103	3	
Game Pass		8100	Apr. 3	64.3	22.4	New Course				1	
Gold Creek Lake	13C8	7200	Apr. 3	53.9	21.2	20.4				2	
Intergaard	13C4	6150	Mar. 31	29.6	8.5	8.0	12.7	8.3	103	7	
North Fork Jocko	13B7	6330	Mar. 31	114.6	45.8	56.3	40.0	39.6	118	11	
Pipestone Pass	12D1	7200	Apr. 1	28.0	6.8	4.2	7.9	5.7	120	13	

G.N.F.

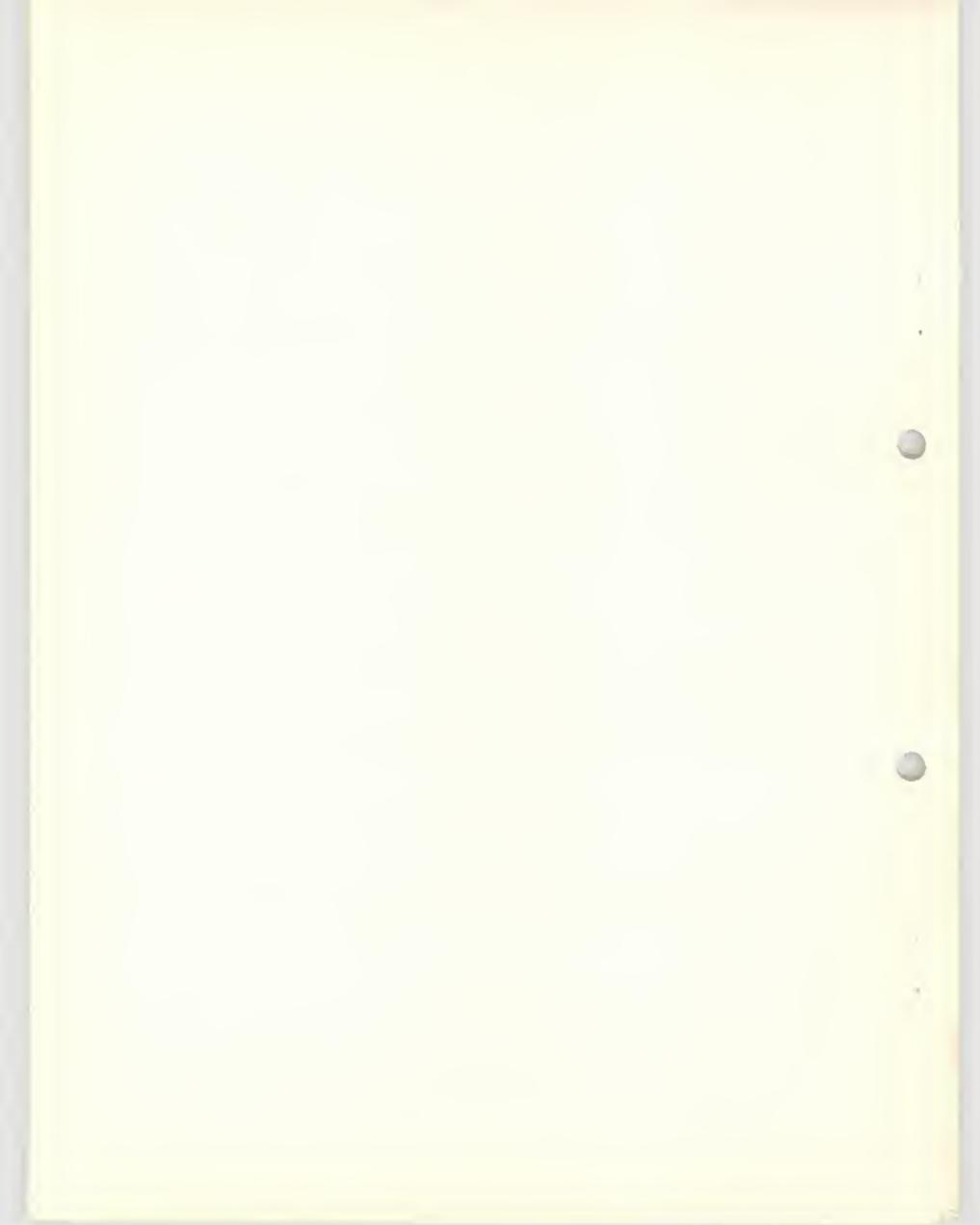


MONTANA SNOW SURVEYS, APRIL 1, 1951

COLUMBIA RIVER BASIN

DRAINAGE BASIN AND SNOW COURSE **	No.	Elev.	Date of Survey 1951	Snow Depth (In.) 1951	Apr. 1 1951	Water Content (Inches)				Years of Record	Ground Surface Condition		
						Past Records		Average Data					
						1950	1949	Avg.	% Avg.				
UPPER CLARK FORK (Continued)													
Rainy Lake	13B6	4200	Apr. 1	14.8	5.1	18.9	11.3	11.9	43	5	---		
Skalizaho Summit	13C3	7258	Apr. 1	82.9	34.4	26.3	36.2	25.0	138	13	---		
Slide Rock	13C2	7100											
Stemple Pass	13C1	6900	Mar. 29	42.4	11.1	11.6	13.5	9.5	117	13	---		
Storm Lake #2	12C7	7780	Mar. 30	48.0	15.6	16.7	16.0	14.3	109	13	G.N.F.		
Stuart Mill	13C6	6500	Mar. 31	27.0	8.2	7.2	9.5	6.7	122	7	---		
Stuart Mount. #1	13C1	7100	Apr. 1	83.8	33.6	37.9	25.4	29.5	114	15	G.N.F.		
Picnic Grounds	12C6	6500	Mar. 31	31.6	5.6	2.5	7.6	4.2	113	7	---		
Southern Cross	13C5	6500	Mar. 31	25.3	7.4	4.4	7.4	5.0	137	7	---		
Tennile, Lower	12C2	6250	Apr. 2	26.4	8.3	7.6	8.8	6.4	130	16	---		
Tennile, Middle	12C3	6800	Apr. 2	42.2	12.0	12.8	12.8	10.3	116	16	---		
Tennile, Upper	12C4	8000	Apr. 3	47.5	15.4	15.8	14.8	13.2	117	16	---		
*Lookout	15B2	5250	Mar. 30	102.0	38.3	47.5	48.7	32.7	118	14	---		
PEND OREILLE													
Baies Mt.	13B1	6000	Mar. 30	109.3	44.2	61.3	55.2	39.7	111	13	G.N.F.		
Freezeout Summit #2	13C10	6800	Apr. 1	119.5	48.3	New Location							
Hodoo Creek	13C1	6200	Apr. 1	135.5	56.6	70.0	59.5	46.4	122	15	---		
*Mosquito Ridge	16A4	5600	Apr. 1	94.0	37.2	50.0	44.5	34.5	108	15	---		
BITTERROOT													
East Fork R. S.	13D1	5400	Mar. 29	30.6	9.2	7.6	10.8	5.1	178	13	---		
Gibbons Pass	13D2	7100	Mar. 29	75.2	28.3	30.0	29.0	22.8	124	13	---		
Mud Creek Pasture	14C1	4500											
Nezperce Camp	14D2	5580	Apr. 2	44.8	13.2	16.0	20.8	13.0	117	15	---		
Nezperce Pass	14D1	6575	Apr. 2	55.8	20.0	20.0	24.0	17.2	117	15	---		
Skalizaho Summit	13C3	7258	Apr. 1	82.9	34.4	26.3	36.2	25.0	138	13	---		
Stuart Mt. #1	13C1	7100	Apr. 1	83.8	33.6	37.9	23.4	29.4	114	15	G.N.F.		
Kit Carson	14D3	4700	Apr. 3	30.2	9.4	9.0	11.0	7.2	130	15	---		
Savage Pass	14C4	6000	Apr. 1	91.5	34.0	34.4	34.6	26.0	131	11	---		
Powell Pasture	15C3	3700	Apr. 1	45.6	15.7	20.4	20.5	13.3	118	14	---		
Packers Meadow	14C2	5700	Apr. 1	66.9	25.5	31.3	34.4	21.5	113	15	---		

* Adjacent Basin





Federal - State - Private
COOPERATIVE SNOW SURVEYS

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Furnishes the basic data
necessary for forecasting
water supply for irrigation,
domestic and municipal water
supply, hydro-electric power
generation, navigation,
mining and industry

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"WATER IS THE WEST'S GREATEST RESOURCE"